Assessed Sensory Quality of Reprocessed Frozen Round Atlantic Herring *(Clupea harengus harengus)*

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ABSTRACT

Botta, J.R., P.B. Noonan and A.P. Downey. 1983. Assessed sensory quality of reprocessed frozen round Atlantic herring (Clupea harengus harengus). Can. Tech. Rep. Fish. Aquat. Sci. 1154:iv + 9p.

Smoking and salting round herring which had been frozen in the round state then stored four months prior to being thawed in air or in water was investigated. These products and control samples, caught simultaneously but processed when fresh, were presented to a sensory evaluation panel. With both the salted and smoked products, the assessed quality of the treated samples did not significantly differ from that of the control samples. This suggests that reprocessing of round herring may be a useful means of overcoming large variations in supplies of herring in the Newfoundland commercial fishery.

Key Words: Atlantic herring, Clupea harengus harengus, quality, reprocessing, salting, smoking.

RÉSUMÉ

Botta, J.R., P.B. Noonan and A.P. Downey. 1983. Assessed sensory quality of reprocessed frozen round Atlantic herring (Clupea harengus harengus). Can. Tech. Rep. Fish. Aquat. Sci. 1154:iv + 9p.

Une étude sur le hareng a l'état brut fumé et salé qui avait été congelé puis emmagasiné pendant quatre mois avant d'etre décongeler a l'air ou dans l'eau est reporté. Ces produits et échantillons de controle, capturés simultanément, et qui avaient été transformés a l'état frais, ont été soumis a un comité de dégustation. Les qualités evaluées pour les produits salés et fumés ne differaient pas significatirement de célles des échantillons de controle. Cela suggére que la retransformation du hareng a l'ètat brut peut ètre un moyen utile pour surmorter les larges variations dans l'approvisionement du hareng dans les pécheries commerciales de Terre-Neuve.

INTRODUCTION

During certain times of the year fish processing plants processing inshore Newfoundland-caught fish may not be able to process all the fish that is available because they are overloaded with one or more species; at other times, such plants are idle due to lack of fish (F. Slade, Canada Department of Fisheries and Oceans, Fisheries Development Branch, St. John's, Nfld; pers. comm.). In recent years, the availability and landings of herring in waters adjacent to Newfoundland have decreased to the extent that it is uneconomical for plants in certain areas to process such small volumes (Anon. 1976-1981; J. Wheeler, Canada Department of Fisheries and Oceans, Fisheries Research Branch, St. John's, Nfld; pers. comm.). Reprocessing of round fatty pelagic fish, although conducted in European countries to solve similar problems (Banks 1951, 1952; Bannerman 1970, 1980; Burgess et al. 1965; Merritt and McLay 1967; and Stroud 1972), is not practiced in Newfoundland (D.R.L. White, Canada Department of Fisheries and Oceans, Inspection Division, St. John's, Nfld; pers. comm.).

Consequently, in order to ensure year-round continuity of supply and to ensure that sufficient herring is available at any specific time to allow such plants to economically engage in secondary processing, the possibility of secondary processing of frozen/thawed round herring was considered and a pilot project was initiated.

MATERIALS AND METHODS

RAW MATERIALS

Herring caught by commercial fishing vessels in Bonavista Bay on Oct. 20, 1980 were landed at Valleyfield, Nfld, transferred to 1 cubic meter covered insulated (with 6.3 cm polyurethane) containers, iced 5 parts fish to 1 part ice and transported to Arnold's Cove, Nfld. Upon arrival, the herring (approximately 15 h post mortem) were divided into two lots. One lot was de-iced, washed and processed immediately.

The other lot was de-iced, washed, placed in 10 kg capacity waxed cardboard boxes with a plastic liner, blast frozen, covered and stored at -18°C for 16 wk. The samples were then placed on racks and thawed in air at 16°C for 21 h or placed in running tap water (1.1°C) for 12 h prior to being processed.

Before being salted (hard cure) or smoked, the fresh or thawed round herring were butterfly filleted using an Arenco automatic filleter.

Some washed fillets were then salted in 23 L capacity barrels with tight fitting lids using a weight ratio of 3 parts fish to 1 part Avalon salt. Once the barrel was filled with salted herring fillets, it was completely filled with saturated brine. The filled barrels were stored at 1.2°C for approximately 4 wk prior to sensory assessment. During the first 4 d of storage, the barrels were rolled once each day; for the duration of storage, they were rolled once each week.

Other washed fillets were soaked in 70° salometer brine for 10 min then smoked using an AFOS Model 200 automatic smoker, for 4 h at 35°C. The smoked fillets were placed in 4.5 kg capacity polyethylene bags and kept refrigerated until sensory assessment was completed (a maximum of 4 d).

ASSESSMENT OF COOKED PROCESSED SAMPLES

The salted fillets were soaked in tap water (3 parts water to 1 part fillet) for 18 h with the water being changed once. They were then transferred to fresh water at a similar ratio and boiled for 13 min. The smoked fillets were placed in aluminum pans, covered with aluminum foil and baked at 218°C for 17 min. The cooked salted or smoked fillets were immediately placed in pre-warmed labelled glass petri dishes and served hot using an electric warming tray. Evaluations were made in partitioned booths with daylight fluorescent lighting and room temperature distilled water for rinsing between samples. In general, samples were evaluated within 15 min of cooking.

The cooked salted or smoked samples from either fresh or thawed herring were each presented to at least 28 judges at various sessions of five or six judges per session. Each judge evaluated three different samples (fillets) of each treatment combination using a 9-point hedonic scale (Table 1).

ASSESSMENT OF DATA

Chi-square (x^2) test was used to determine if there were any significant differences among frequency distributions of sensory evaluation scores (the number of times each treatment received each of the scores) for the three types of samples that were salted or for the three types of samples that were smoked (Snedecor and Cochran 1980). If some of the expected frequencies were too small (less than 1.0), then categories were combined to eliminate these small expected frequencies (Conover 1971). It should be noted that the x^2 test was computed on the raw data, not on percentages as presented in the tables. Unless otherwise indicated "significant" means significant at the 5% level (i.e. the probability of the difference occurring by chance alone is 5%).

RESULTS AND DISCUSSION

SENSORY QUALITY

The sensory quality of the cooked salted herring was quite good (the vast majority of samples received scores of 6 or higher) and was not significantly affected by freezing (round fish), storage at -18°C for 16 wk and thawing in air or in water prior to salting (Table 2).

The sensory quality of cooked smoked herring that were processed using fresh fish was very good (the vast majority of samples receiving scores of 7 or higher) (Table 3). The sensory quality of the smoked products that were processed using frozen (round), stored at -18°C, then thawed (in air or in water) herring was also very good and did not significantly differ from that of the smoked products derived from fresh herring (Table 3). In general, the smoked products were rated substantially higher than the corresponding salted products (Tables 2 and 3).

It should be noted that in order to determine how much they liked or disliked the cooked products, the judges evaluated appearance, flavor, odor and texture of each sample.

GENERAL DISCUSSION

The post mortem age of the herring at time of freezing was less than 18 h and the frozen storage temperatures were quite low and non-fluctuating (Fig. 1). Thus, considering these factors, how they were processed, as well as the European experience (Anon. 1965; Bannerman 1970, 1980; Burgess et al. 1965; Stroud 1972), the good quality of the reprocessed round fish is not overly surprising. Although the fish were processed under industrial conditions, they were handled well; if reprocessing in Newfoundland is to be successful on a commercial basis, the fish must also be handled well. Herring must be handled carefully to avoid bruising, chilled rapidly, frozen rapidly within 24 h of catching, packaged well to avoid desiccation and rancidity, stored at a low non-fluctuating temperature and, if air thawed, conducted at a temperature no higher than 18°C. If water thawed, the water should not be warmer than 21°C and, for rapid thawing, should be moving at a rate of 0.3 meters per minute (Anon. 1965; Bannerman 1970; Stroud 1972; Varga 1976). For slower thawing, such as that used in the present study, temperatures much colder than 21°C may be used. Regardless of the method of thawing, the thawed fish should be processed immediately.

The present results indicate technological feasibility of transporting round herring over 325 km from where they were landed then freezing and subsequently reprocessing the thawed round herring. However, the study does not address the question of economic feasibility. It should also be stressed that the sensory quality of the reprocessed products was determined by laboratory sensory evaluation panels whose assessment will not necessarily agree with that of the general public. Consequently, the present study should be viewed as the first of a series of hurdles, the others being consumer studies, test marketing and economic analysis (R.C. Baker, Department of Food Sciences, Cornell University, Ithaca, N.Y.; pers. comm.).

CONCLUSIONS

A laboratory-type study was conducted to evaluate the feasibility of reprocessing round herring as a means of overcoming large variations in supplies of herring in the Newfoundland commercial fishery.

Blast freezing, storage at -18°C for 16 wk and thawing in air or in water prior to processing did not significantly affect the sensory quality of cooked salted (hard cure) or hot smoked fillets. Reprocessing round herring appears to be an appropriate means of overcoming variations in supply but, before such procedures are commercially implemented, consumer studies, test marketing and economic analyses need to be conducted.

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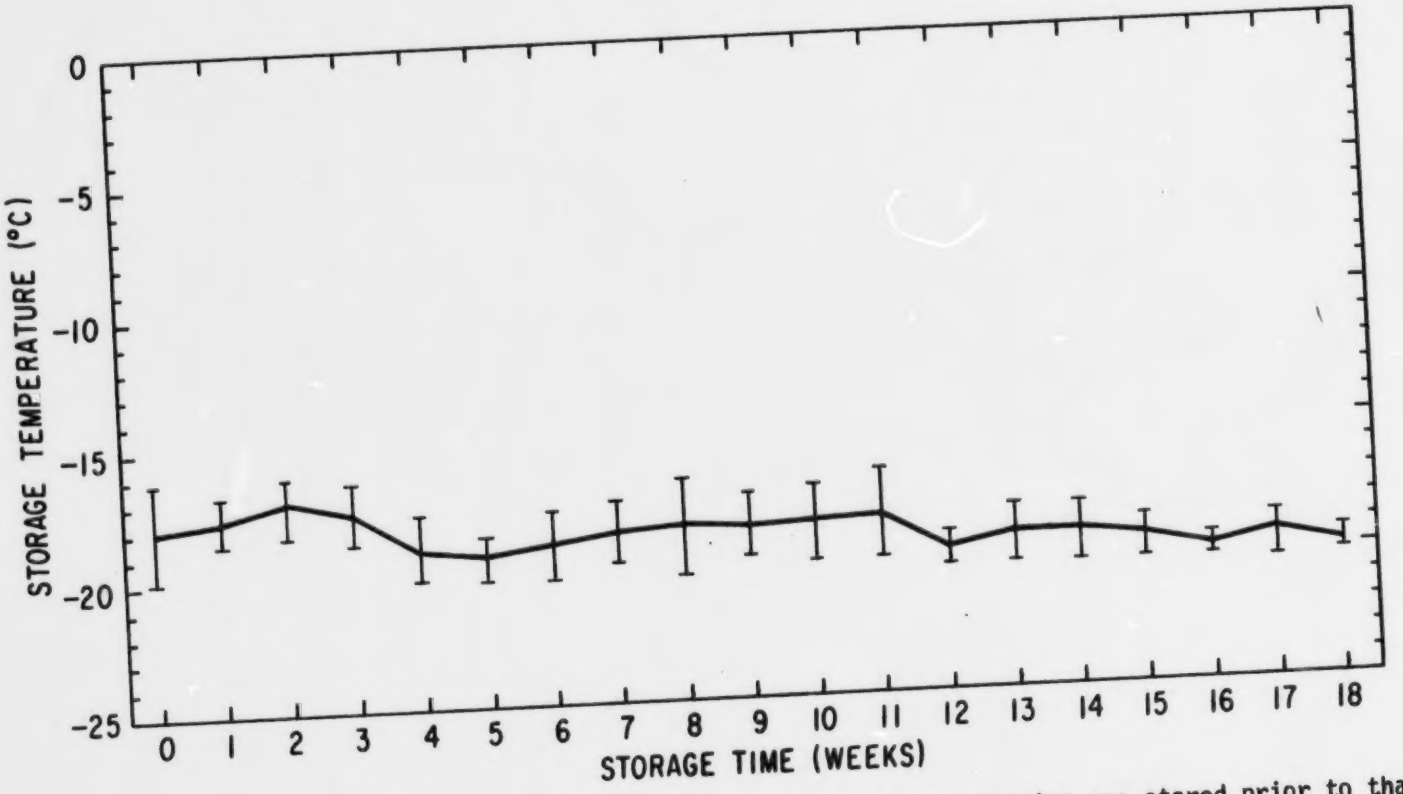

Fig. 1. Weekly mean temperature and standard deviation at which round herring was stored prior to thawing.

Table 1. Form used to assess sensory quality of cooked, salted or smoked herring.

DATE _____ TASTER _____

PRODUCT _____

Taste test these samples and check how much you like or dislike each one. Use the appropriate scale to show your attitude by checking at the point that best describes your feeling about the sample. Please give a reason for this attitude. Remember you are the only one who can tell what you like. An honest expression of your personal feeling will help us.

Code	Code	Code
____	____	____
___ Like extremely	___ Like extremely	___ Like extremely
___ Like very much	___ Like very much	___ Like very much
___ Like moderately	___ Like moderately	___ Like moderately
___ Like slightly	___ Like slightly	___ Like slightly
___ Neither like nor dislike	___ Neither like nor dislike	___ Neither like nor dislike
___ Dislike slightly	___ Dislike slightly	___ Dislike slightly
___ Dislike moderately	___ Dislike moderately	___ Dislike moderately
___ Dislike very much	___ Dislike very much	___ Dislike very much
___ Dislike extremely	___ Dislike extremely	___ Dislike extremely
REASON:	REASON:	REASON:

Table 2. Salted herring fillets (hard cure): Observed frequency distributions (the percentages of times each treatment received each of the scores) for sensory evaluation scores of the subsequently cooked samples and a test of the hypothesis that the frequency distributions of the three treatments are the same.

TREATMENT	Sensory Evaluation Score[a]								
	1	2	3	4	5	6	7	8	9
	Observed frequencies (percentages; n = 84)[b]								
Salted when fresh	0.0	2.4	3.6	11.9	6.0	19.0	36.9	19.0	1.2
Salted after ungutted fish stored at -18°C (0°F) for 4 months were thawed in air at 16°C (61°F) for 21 h	0.0	2.4	7.1	11.9	9.5	26.2	27.4	15.5	0.0
Salted after ungutted fish stored at -18°C (0°F) for 4 months were thawed in water at 1.1°C (34°F) for 12 h	0.0	3.6	7.1	10.7	4.8	16.7	41.7	14.3	1.2
Total Chi-square (x^2) with 12 d.f.	$8.35^{n.s.}$								

[a] 1 = Dislike extremely
2 = Dislike very much
3 = Dislike moderately
4 = Dislike slightly
5 = Neither like nor dislike
6 = Like slightly
7 = Like moderately
8 = Like very much
9 = Like extremely

[b] n = number of observations per treatment.

Table 3. Smoked herring fillets: Observed frequency distributions (the percentages of times each treatment received each of the scores) for sensory evaluation scores of the subsequently cooked samples and a test of the hypothesis that the frequency distributions of the three treatments are the same.

TREATMENT	Sensory Evaluation Score[a]								
	1	2	3	4	5	6	7	8	9
	Observed frequencies (percentages; n = 90)[b]								
Smoked when fresh	0.0	0.0	0.0	3.3	2.2	5.6	27.8	50.0	11.1
Smoked after ungutted fish stored at -18°C (0°F) for 4 months thawed in air at 16°C (61°F) for 21 h	0.0	0.0	0.0	6.7	2.2	7.8	26.7	50.0	6.7
Smoked after ungutted fish stored at -18°C (0°F) for 4 months were thawed in water at 1.1°C (34°F) for 12 h	0.0	0.0	3.3	4.4	1.1	15.6	35.6	34.4	5.6
Total Chi-square (X^2) with 12 d.f.				13.83[n.s.]					

[a] 1 = Dislike extremely; 2 = Dislike very much; 3 = Dislike moderately; 4 = Dislike slightly; 5 = Neither like nor dislike; 6 = Like slightly; 7 = Like moderately; 8 = Like very much; 9 = Like extremely

[b] n = number of observations per treatment